

WHAT IS CLAIMED IS:

1 1. A method for controlling at least one of an
2 automated clutch and an automated transmission in a motor
3 vehicle, wherein a target value for a clutch torque is
4 determined by means of an electronic clutch management system
5 as an output quantity of a start-up function, dependent on
6 suitable input quantities.

1 2. The method according to claim 1, wherein said
2 suitable input quantities include at least one of the group
3 consisting of accelerator pedal angle, engine rpm-rate,
4 transmission input rpm-rate, and engine torque.

1 3. The method according to claim 2, wherein the
2 start-up function is substantially divided into at least two
3 phases by means of a factor calculation.

1 4. The method according to claim 3, wherein in a
2 first phase of said two phases the engine rpm-rate is
3 substantially matched to a target value (a_start) of a
4 starting rpm-rate in order to regulate the starting rpm-rate,
5 and in a second phase of said two phases, the engine rpm-rate
6 is synchronized with the transmission input rpm-rate.

1 5. The method according to claim 1, wherein for said
2 determination of the target value for the clutch torque, a
3 global torque contribution is determined by means of a global
4 control.

1 6. The method according to claim 5, wherein the
2 global torque contribution is determined as a combination of
3 a plurality of contributions.

1 7. The method according to claim 6, wherein at least
2 one of said plurality of contributions is determined as a
3 function of at least one of the transmission input rpm-rate
4 and the engine rpm-rate.

1 8. The method according to claims 7, wherein one of
2 said plurality of contributions comprises an engine-torque-
3 dependent contribution ($KME \cdot Me$).

1 9. The method according to claim 8, wherein said
2 engine-torque-dependent contribution is weighted with an rpm-
3 ratio (SR) conforming to the equation $SR = n_{trsm}/n_{eng}$, so
4 that when synchronism is achieved at the clutch, the engine-

5 torque-dependent portion is substantially fully effective.

1 10. The method according to claim 9, wherein the
2 weighted engine-torque-dependent contribution ($SR \cdot KME \cdot Me$) is
3 subject to a limitation of its time gradient.

1 11. The method according to claim 10, wherein said
2 plurality of contributions is supplemented by at least one
3 controller contribution in order to ensure the performance of
4 phase-specific tasks in the start-up function.

1 12. The method according to claim 9, wherein at
2 lower values of the rpm-ratio (SR) priority is given to
3 regulating a start-up rpm-rate (n_{start}) in accordance with a
4 a target value and wherein said start-up rpm-rate is
5 determined by means of a characteristic curve at least as a
6 function of an accelerator pedal angle.

1 13. The method according to claim 12, wherein the
2 start-up rpm-rate is further processed through a filter.

1 14. The method according to claim 13, wherein said
2 filter comprises a low-pass filter.

1 15. The method according to claim 13, wherein the
2 filter is initialized with the engine rpm-rate (n_{eng}) if the
3 engine rpm-rate (n_{eng}) in neutral gear considerably exceeds
4 an idling rpm-rate.

1 16. The method according to claim 11, wherein a
2 weighted difference ($f_1(SR) * (n_{start} - n_{eng})$) with a weight
3 factor $f_1(SR)$ being a function of the rpm-ratio (SR) is
4 converted through a proportional/integrating controller into
5 a contribution to a target value for the clutch torque
6 (M_{Rtrgt}).

1 17. The method according to claim 9, wherein at
2 higher values of the rpm-ratio (SR) priority is given to
3 attaining synchronism and a proportional/integrating
4 controller is used, wherein a weighted difference (f_2
5 ($SR) * (n_{eng} - n_{trsm})$) with a weight factor $f_2(SR)$ being a
6 function of the rpm-ratio (SR) serves as an input signal to
7 the proportional/integrating controller and is converted into
8 a contribution to a target value for the clutch torque
9 M_{Rtrgt} .

1 18. The method according to claim 16, wherein a
2 first weighted difference ($f_1(SR) \cdot (n_{start} - n_{eng})$) and a
3 second weighted difference ($f_2(SR) \cdot (n_{start} - n_{eng})$) with
4 weight factors $f_1(SR)$ and $f_2(SR)$ being functions of the rpm-
5 ratio (SR) are each converted by their own
6 proportional/integrating controller into a contribution to a
7 target value for the clutch torque (M_{Rtrgt}), and wherein the
8 respective integrating portions of the two
9 proportional/integrating controllers are implemented by a
10 joint integrator.

1 19. The method according to claim 18, wherein an
2 additional integrator is used in addition to the joint
3 integrator.

1 20. The method according to claim 19, wherein the
2 additional integrator is arranged in series with the joint
3 integrator, and wherein the additional integrator uses a
4 comparatively small amplification parameter ($KI3$).

1 21. The method according to claim 19, wherein the
2 target value for the clutch torque (M_{Rtrgt}) determined as
3 the output quantity is subject to a limitation.

1 22. The method according to claim 21, wherein in
2 limiting the target value for the clutch torque (M_{Rtrgt}) at
3 least in a first phase where the target value for the clutch
4 torque (M_{Rtrgt}) is low, a new start-up function is matched
5 to an existing start-up function, and the new start-up
6 function is allowed to diverge from the existing start-up
7 function only in a second phase where the target value for
8 the clutch torque (M_{Rtrgt}) increases.

1 23. The method according to claims 22, wherein in
2 limiting the target value for the clutch torque (M_{Rtrgt}),
3 each integrator is subjected to a measure to avoid the so-
4 called wind-up.

1 24. The method according to claim 23, wherein after
2 limiting the target value for the clutch torque (M_{Rtrgt}),
3 an integral portion (M_I) is calculated according to the
4 equation:

5 $M_I = M_{Rtrgt_lim} - M_{glob} - M_D + M_{P1} + M_{P2}$, wherein
6 M_{Rtrgt_lim} = limited target value for the clutch torque
7 M_D = damping torque portion
8 M_{P1} = proportional torque portion of the

9 proportional/integrating controller in the first phase, and
10 M_P2 = proportional torque portion of the
11 proportional/integrating controller in the second phase.

1 25. The method according to claim 24, wherein the
2 damping torque portion (M_D) is used in determining the
3 start-up function.

1 26. The method according to claim 24, wherein the
2 damping torque portion (M_D) is used in at least one of
3 regulating the starting rpm-rate during the first phase and
4 synchronizing the engine rpm-rate with a transmission rpm-
5 rate during the second phase.

1 27. The method according to one of claim 26, wherein
2 at least one of the transmission input rpm-rate (n_trsm) and
3 the engine rpm-rate (n_eng) is disregarded in determining the
4 start-up function.

1 28. The method according to claim 22, wherein a
2 throttle-valve-dependent portion ($K(\alpha)$) is used in
3 determining the start-up function.

1 29. The method according to claims 28, wherein the
2 target value for the clutch torque (M_{Rtrgt}) conforms to the
3 equation:

4 $M_{Rtrgt} = K(\alpha) * f(n_{eng})$, wherein $f(n_{eng})$ represents a
5 function of the engine rpm-rate.

1 30. The method according to one of claim 29, wherein
2 the time derivative of the clutch torque (M_{Rtrgt}) conforms
3 to the equation:

4
$$\frac{d}{dt} M_{Rtrgt} = f(n_{eng}) * \frac{dK(\alpha)}{d\alpha} * \frac{d\alpha}{dt} + K(\alpha) * \frac{df(n_{eng})}{dn_{eng}} * \frac{dn_{eng}}{dt},$$

5

6 wherein n_{eng} represents the engine rpm-rate and $K(\alpha)$
7 represents the throttle-valve-dependent portion.

1 31. The method according claim 30, wherein at least
2 one of the throttle-valve-dependent portion ($K(\alpha)$) and the
3 engine-rpm-rate-dependent portion $f(n_{eng})$ is subject to a
4 limitation of its respective time gradient.

1 32. The method according to claim 31, wherein the
2 time gradient $dK(\alpha)/dt$ is subject to a limitation designed to
3 reduce the influence of $K(\alpha)$ in such a way that undesired
4 accelerations of the vehicle are avoided.

1 33. The method according to claim 30, wherein a drop
2 in the target value for the clutch torque (M_{Rtrgt}) during an
3 engine-load change as a result of an abrupt depression of the
4 gas pedal is avoided by imposing a limitation on the time
5 gradient $(dK(\alpha)/dt)$.

1 34. The method according to claim 30, wherein a
2 sudden closing of the clutch during an engine-load change as
3 a result of an abrupt let-up on the gas pedal is avoided by
4 imposing a limitation on the time gradient $(dK(\alpha)/dt)$.